

# First fossil soft ticks, *Ornithodoros antiquus* n. sp. (Acari: Argasidae) in Dominican amber with evidence of their mammalian host

G. O. Poinar, Jr

Division of Entomology, University of California, Berkeley (California 94720, USA)

Received 7 September 1994; accepted 22 November 1994

**Abstract.** A male and female soft tick, *Ornithodoros antiquus* n. sp. (Acari: Argasidae) from Dominican Republic amber are described. This represents the first description of a fossil soft tick. The fossils share characters with members of the subgenera *Pavlovskyella* and *Alectorobius* but differ from extant members in a combination of characters. It is postulated that *O. antiquus* lived with its mammalian host (probably a rodent) in a cavity of the resin-bearing tree (*Hymenaea protera*: Fabaceae) some 30–40 million years ago.

**Key words.** Fossil soft tick; Argasidae; *Ornithodoros*.

The fossil record of soft ticks is essentially nonexistent. A possible *Ornithodoros* soft tick in Dominican amber was mentioned in Poinar<sup>1</sup> but this specimen was never figured or described and its whereabouts are unknown. Hard ticks (Ixodidae) occur in Dominican and Baltic amber and their presence has been recorded<sup>2</sup>. The present report of a male and female soft tick in Dominican amber is the first description of a fossil soft tick. The amber piece containing the male tick is broadly elliptical in outline, with the greatest length 46 mm, the greatest width 35 mm and the greatest depth 10 mm. The piece weighs 10.5 grams and is a uniform golden color. The amber piece containing the female tick is elliptical in outline, with the greatest length 85 mm, the greatest width 46 mm and the greatest depth 15 mm. The piece weighs 17.5 grams and is a uniform golden color. Both amber pieces originated from the La Toca mine in the Cordillera Septentrional mountain range in the northern portion of the Dominican Republic. An analysis of amber from seven Dominican mines by nuclear magnetic resonance spectroscopy suggests that amber from La Toca is approximately 30 to 40 million years old<sup>3</sup>.

## Description

Both specimens are well preserved with the dorsal and ventral views unobstructed. In the description that follows, all measurements are in millimeters. Terms used in the description are for the most part defined by Cooley and Kohls<sup>4</sup>.

*Ornithodoros antiquus* n. sp.  
(Acari: Argasidae)

### Unfed male (figs 1–6)

**Body** – Oval, wider behind, pointed anteriorly. Length, 4.50, width 2.36, depth 0.60. Color light tan.

**Mammillae** – Numerous and large in size, noticeably projecting from the body surface, larger posterior mammillae containing 2–3 radiating lines. Slightly smaller in the anterior region of the body.

**Hairs** – Only very few fine hairs visible on the body.

**Discs** – Fifteen well-defined discs present on the dorsal surface. Posterior portion of dorsum also contains three equally-spaced broad ridges that extend approximately over the latter fourth of the body. No discs noted on the ventral surface.

**Legs** – Similar tan color, surface of legs not micromammillated, with some hairs present; length of tarsus I, 0.42; length of tarsus IV, 0.31; all tarsi lacking dorsal humps, but the first and second with subapical dorsal protuberances, which are especially distinct on tarsi I. Paired claws lacking pulvilli.

**Coxae** – Coxae I and II are separated, the remainder are contiguous.

**Hood** – Distinct as an interior projection above the capitulum, not continuous with the anterior expansion of the dorsal body wall, directed downwards but slightly turned up at tip.

**Camerostome** – Deep posteriorly, shallow anteriorly.

**Cheeks** – Present, flap-like and flanking the palps.

**Capitulum** – Basis capituli, 0.14 long and 0.28 wide at base, narrowed slightly at anterior margin, surface irregular with transverse wrinkles. No hairs noted at base.

**Palpi** – Surface smooth, tips projecting ventrally, base of article 1 appears to be attached to a flange extending over the base of the hypostome; articles 2, 3 and 4 free. Postpalpal hairs absent.

**Hypostome** – Length, 0.18; denticles present but unable to see their arrangement due to difficulties of resolution through the amber; a distinct pair of posthypostomal hairs present.

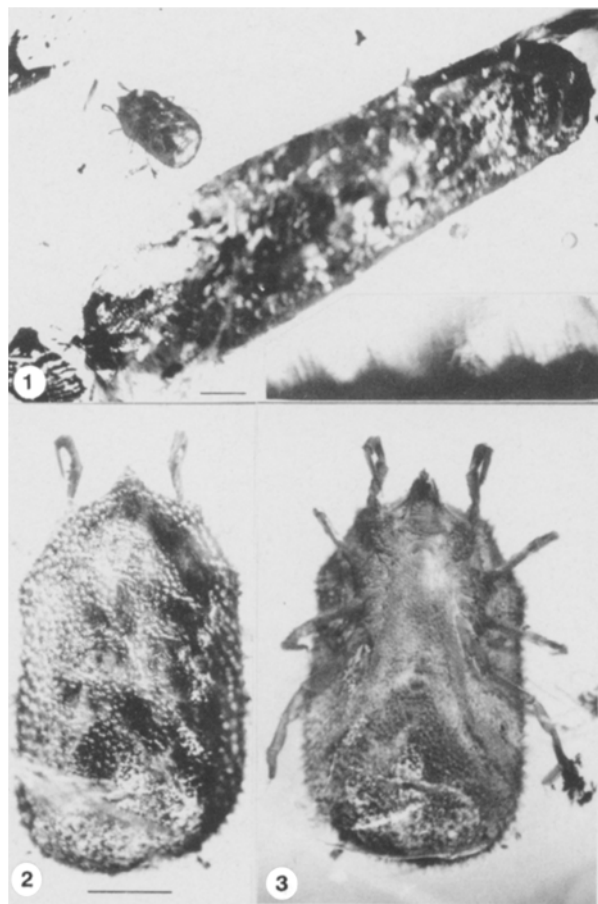


Figure 1. *Ornithodoros antiquus* n. sp. adjacent to a suspected rodent scat (bar = 2.15 mm) (insert shows mammillae with radiating lines).

Figure 2. Dorsum of *Ornithodoros antiquus* n. sp. (bar = 0.9 mm).

Figure 3. Ventral surface of *Ornithodoros antiquus* n. sp. (same mag. as fig. 2).

**Folds** – Supracoxal and coxal folds present, the former extending from the spiracles to the hood, the latter especially well-formed and distinct.

**Grooves** – Dorsal-ventral groove present, but faint, visible only on the ventral surface. Preanal groove pronounced, not sinuous, transverse section straight, anterior to border of anus, median postanal groove distinct and broad, not reaching anus, transverse postanal grooves ending before posterior border.

**Genital aperture** – Located between the first pair of coxae – just posterior to the basis capituli.

**Eyes** – Not present

**Anus** – Oval in outline, situated half way between the transverse portion of the preanal groove and the anterior portion of the postanal groove.

**Spiracles** – Located opposite coxae IV.

**Holotype specimen** – In the private collection of Jim Work, of Ashland, Oregon.

### Unfed female

This specimen resembles the male in regards the mammillae, hairs, disc number and arrangement, leg structure, coxal arrangement, hood structure, type of cheeks, spiracle location and the number and arrangement of folds and grooves. However, the camerostome, capitulum, palpi and hypostome were obscured and could not be characterized. The genital aperture was almost circular and extended slightly beyond the posterior margins of the first pair of coxae. The anus is similar to that of the male, oval and situated just posterior to the transverse portion of the preanal groove. Body oval, wider behind. Length 7.26, width 4.65, depth 0.80; tan color.

**Allotype specimen** – In the private collection of Jim Work, of Ashland, Oregon.

### Diagnosis

The combination of characters of *O. antiquus* places it nearest to the subgenera *Pavlovskyella* Popelova–Shtrom, 1950 and *Alectorobius* Pocock, 1907 as defined by Clifford et al.<sup>5</sup> Diagnostic characters separating *O. antiquus* n. sp. from extant New World members of those subgenera include 1) the presence of distinct mammillae with 2–3 radiating lines, 2) basis capituli wider than long, 3) non-sinuous preanal groove, 4) genital aperture located between the first pair of coxae, 5) configuration and shape of the palpi and 6) body size and shape. The fossil species is closest to and shares many characters with *O. puertoricensis* Fox<sup>6</sup>. It differs from the latter species in possessing a dorsal-ventral groove, having the legs of uniform coloration (first pair darker in *O. puertoricensis*), its larger length, and the number and arrangement of the dorsal discs.

Although records of extant *Ornithodoros* in Hispaniola could not be found, it is very likely that *Ornithodoros* spp. occur there since Cooley and Kohls<sup>4</sup> list representatives of this genus from Mexico, Central America and Cuba, and Fox<sup>6</sup> described an *Ornithodoros* from Puerto Rico.

### Discussion

According to Clifford et al.<sup>5</sup> extant representatives of *Ornithodoros* parasitize small, burrow-inhabiting animals, particularly mammals, birds and reptiles, where the ticks occur in the burrows of their hosts. It is possible that *O. antiquus* was living in a cavity of the resin-producing *Hymenaea protera*<sup>7</sup> tree and fed on a host that co-habitated the same abode.

Evidence to the identity of this host is provided in the amber piece containing the male tick. Adjacent to the tick is a dark cylindrical object that has been identified as an animal dropping (scat) (fig. 1). The lack of a white smear or pellet attached to this scat suggests that it was deposited by a mammal<sup>8</sup>. The scat is composed of fibrous plant material without any evidence of bone or

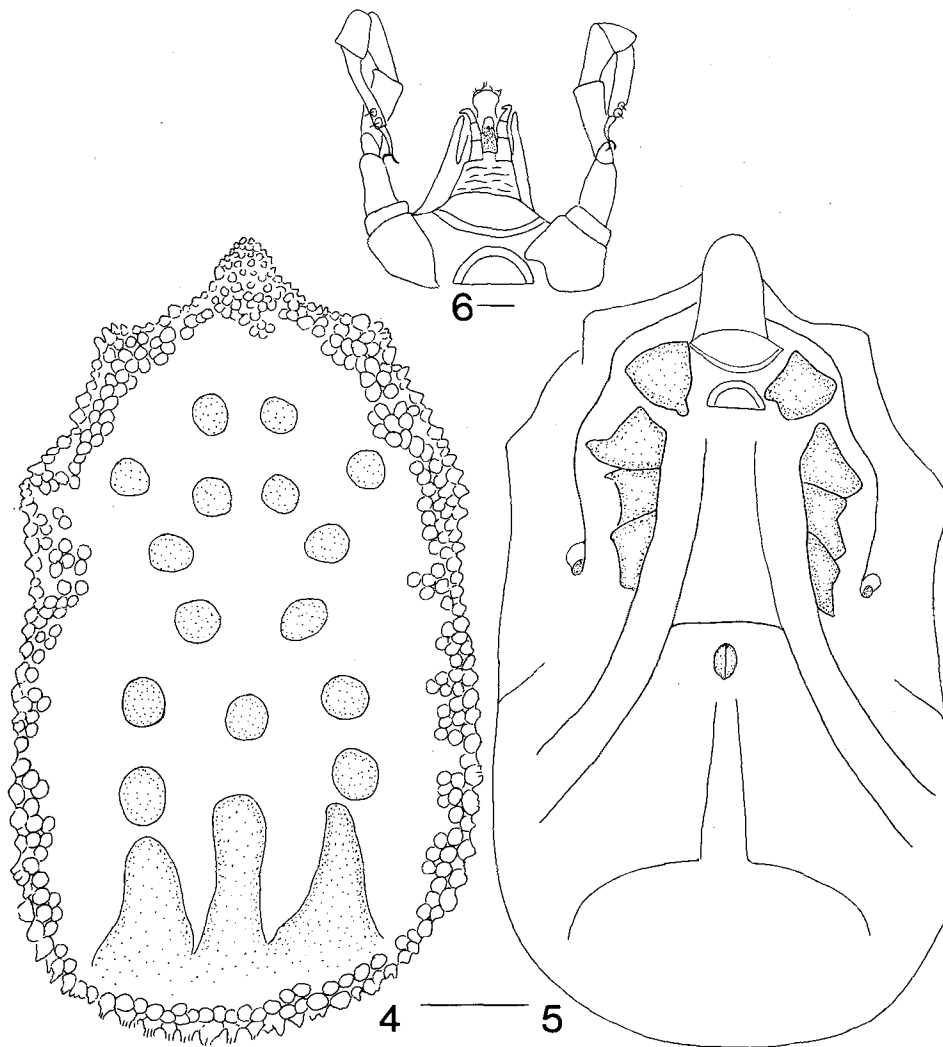


Figure 4. Dorsum of *Ornithodoros antiquus* n. sp. showing discs and mammillae (bar = 6.1 mm).

Figure 5. Ventral surface of *Ornithodoros antiquus* n. sp. (bar = 6.1 mm).

Figure 6. Ventral view of capitulum of *Ornithodoros antiquus* n. sp. showing hypostome, palpi, first pair of legs and genital opening (bar = 0.18 mm).

arthropod remains. This, coupled with the shape, size and location (probably in a tree cavity) of the scat suggests that it was deposited by a rodent. Scats of the brown rat (*Rattus norvegicus*) are identical in shape to those of the fossil scat<sup>9</sup>, but are somewhat smaller (17 mm long by 6 mm wide for the brown rat and 25 mm and 8 mm wide for the fossil scat). Although the rodent that might have deposited the scat is unknown, a possible candidate would be a Hutia, a member of the endemic West Indian family Capromyidae with one species of the genus *Plagiodontia* still existing (but near extinction) in Hispaniola<sup>10</sup>. The Dominican Hutia is slightly larger than the brown rat (the Hutia ranges from 20–60 cm in length while the brown rat ranges from 20–26 cm) which would account for the larger size of the fossil scat<sup>9,10</sup>.

Supporting evidence that the scat is from a mammal and possibly a rodent is derived from hair located near

the scat in the same amber piece. Although the medulla is partially deteriorated and the scale pattern on the cuticle was obscured, the hair diameter (25–38  $\mu\text{m}$ ) was similar in size to hair reported earlier from Dominican amber<sup>11</sup> which was tentatively identified as rodent hair.

Although the biology of Hutias are poorly known, as well as the fossil record, those occurring in Cuba and Hispaniola are arboreal and feed on plant material. A possible scenario might have been that rodents living in a cavity of a *Hymenaea protera* tree used one portion of the cavity to void their waste. At one point, an animal released a scat into the resin, at the same time dislodging a tick that had just crawled onto it in search of a blood meal. It is interesting that Fox<sup>6</sup> reported that with the closely related *O. puertoricensis*, which attacks *R. norvegicus*, the adult ticks remain hidden in the rat's nest. Other insects that occurred in the amber piece with the

holotype male were a scuttle fly (Diptera: Phoridae), two fungus gnats (Diptera: Mycetophilidae), a beetle (Coleoptera) and a pair of sand flies (Diptera: Psychodidae) belonging to the genus *Lutzomyia*. Insects that were present in the amber piece with the allotype female included an assassin bug nymph (Hemiptera: Reduviidae), three fungus gnats (Diptera: Mycetophilidae), a worker ant (Hymenoptera: Formicidae), a female mosquito (Diptera: Culicidae), a male sand fly (Diptera: Psychodidae), and a juvenile cricket (Grylloptera: Trigonidiidae). At least two of the above insects are parasites (the sand fly and mosquito) and possibly the assassin bug also. The remainder could well be found in or around tree cavities.

Some extant species of *Ornithodoros* are known to bite humans and several of these species are vectors of tick-bone spirochetes<sup>5,12</sup>. The fossil ticks could be carrying a primitive spirochete infective to their mammalian host in the cavity of the *Hymenaea* tree.

**Acknowledgments.** The author gratefully acknowledges the assistance of Robert S. Lane during the preparation of this manuscript.

- 1 Poinar, G. O. Jr, Life in Amber. Stanford Univ. Press, Stanford, CA 1992.
- 2 Lane, R. S., and Poinar G. O. Jr, Int J. Acarol. 12 (1986) 75.
- 3 Lambert, J. B., Frye, J. S. and Poinar, G. O. Jr, Archaeometry 27 (1985) 43.
- 4 Cooley, R. A., and Kohls, G. M., The Argasidae of North America, Central America and Cuba. The American Midland Naturalist, Monograph No. 1. The University Press, Notre Dame, Indiana 1944.
- 5 Clifford, C. M., Kohls, G. M., and Sonenshine, D. E., Ann. ent. Soc. Am. 57 (1964) 429.
- 6 Fox, I., J. Parasit. 33 (1947) 253.
- 7 Poinar, G. O. Jr, Experientia 47 (1991) 1075.
- 8 Morrison, R. G. B., A Field Guide to the Tracks and Traces of Australian Animals. Rigby Publishers Ltd., Adelaide 1981.
- 9 Brown, R., and Lawrence, M., Mammals – Tracks and Signs. The Oregon Press, Ltd., London 1983.
- 10 Macdonald, D., The Encyclopedia of Mammals. Facts on File, Inc., New York 1984.
- 11 Poinar, G. O. Jr, Experientia 44 (1988) 88.
- 12 Kettle, D. S., Medical and Veterinary Entomology. John Wiley & Sons, New York 1984.

---

## EXPERIMENTAL WORLD

News items and opinions from the sphere of the life sciences are reported in *EXPERIMENTAL WORLD* under the headings Science Policy, Research, Personalia/Prizes, Scene and Correspondence. All contributions are welcomed and should be sent directly to: Dr. M. J. Parnham, Von Guericke Allee 4, D-53125 Bonn, Germany. Tel. +49 (0)228 25 91 29, Fax +49 (0)228 25 66 63.

---